# Anatomy and Embryology

Volume 176 1987

# **Managing Editors**

#### R. Bellairs

Department of Anatomy and Embryology University College London Gower Street London WC1E 6BT, UK

#### K. Fleischhauer

Anatomisches Institut der Universität Nussallee 10 D-5300 Bonn, FRG

#### W.-G. Forssmann

Anatomisches Institut der Universität Im Neuenheimer Feld 307 D-6900 Heidelberg, FRG

#### W. Kriz

Anatomisches Institut der Universität Im Neuenheimer Feld 307 D-6900 Heidelberg, FRG

#### S.L. Palay

Dept. of Anatomy, Harvard Medical School 25 Shattuck Street Boston, MA 02115, USA

# F. Walberg

Anatomisk Institutt Karl Johans Gate 47 N-0162 Oslo 1, Norway

# **Editors**

#### G. Burnstock

Department of Anatomy and Embryology University College London Gower Street London, WC1E 6BT, UK

#### B. Christ

Institut für Anatomie Ruhr-Universität Bochum Universitätsstr. 150 D-4630 Bochum 1, FRG

#### N. Le Douarin

Institut d'Embryologie Centre National de la Recherche Scientifique Annexe du Collège de France 49 bis, Av. de la Belle Gabrielle F-94130 Nogent-sur-Marne, France

#### H.-R. Duncker

Institut für Anatomie und Zytobiologie Justus-Liebig-Universität Aulweg 123 D-6300 Giessen, FRG

#### Giorgio Gabella

Department of Anatomy and Embryology University College London Gower Street London WC1E 6BT, UK

#### M.D. Gershon

Department of Anatomy and Cell Biology College of Physicians and Surgeons of Columbia University 630 West 168th St. New York, NY 10032, USA

#### K. Hama

Division of Morphology National Institute for Physiological Sciences Myodaiji, Okazaki, 444 Japan

#### E. Mugnaini

Department of Biobehavioral Sciences University of Connecticut Storrs, CT 06268, USA

#### R. Nieuwenhuys

Department of Anatomy and Embryology University of Nijmegen Geert Grooteplein Noord 21 NL-6500-HB Nijmegen, The Netherlands

## G. Rager

Institut d'Anatomie et d'Embryologie Spéciale 1, rue Gochel CH-1700 Fribourg, Switzerland

## K. Zilles

Anatomisches Institut der Universität Joseph-Stelzmannstr. 9 D-5000 Köln 41, FRG

Manuscripts may be sent to any member of the Editorial Board



Springer International

# **Anatomy and Embryology**

Continuation of Zeitschrift für Anatomie und Entwicklungsgeschichte

This Journal was founded in 1876 as the Zeitschrift für Anatomie und Entwicklungsgeschichte, edited by W. His and W. Braune and published by F.C.W. Vogel in Leipzig. After its second year, in 1877, the Journal became the Anatomische Abteilung of the Archiv für Anatomie und Physiologie, edited by His and Braune and published by Veit & Co. in Leipzig. From 1892 through 1903 His was the sole editor. In 1904 W. Waldeyer became the editor. From 1913 until 1919 it appeared as Archiv für Anatomie, edited by W. von Waldeyer-Hartz, H. Virchow and P. Röthig. It was published until 1915 by Veit & Co. in Leipzig and later by de Gruyter & Co. in Berlin.

After 1919 publication was suspended, but in 1921 the Archiv für Anatomie merged with Anatomische Hefte to become Abteilung 1 of the Zeitschrift für die gesamte Anatomie. Anatomische Hefte had begun in 1892 with F. Merkel and R. Bonnet as editors and J.F. Bergmann as publisher in Wiesbaden. In 1919 E. Kallius and F. Heiderich became the editors and Bergmann moved to Munich. Fifty nine volumes had been published by 1920. When the Journals combined in 1921, the numbering of the volumes continued the unbroken sequence of Anatomische Hefte, but the name adopted was the original name of the older Journal. Therefore, the Zeitschrift für Anatomie und Entwicklungsgeschichte (Abteilung 1 of the Zeitschrift für die gesamte Anatomie) re-appeared as volume 60 in 1921. J.F. Bergmann, Munich and J. Springer, Berlin were the joint publishers. The editors were coopted from both parent Journals – Waldeyer-Hartz and Kallius, with the addition of H. Braus for the first three volumes. From volume 63 to volume 76 inclusive, Kallius and Braus were the editors and from volume 77 to volume 103 Kallius was the sole editor. From volume 88 onwards Springer became the sole publisher.

In 1934, with no. 3 of volume 103, Curt Elze became the editor and the full title of the Journal became simply Zeitschrift für Anatomie und Entwicklungsgeschichte. From volume 116 to volume 121 Elze shared the editing work with K. Zeiger and from volume 122 to volume 126 with R. Ortmann. With volume 126 Ortmann became the Managing Editor and was soon joined (volume 127) by an international Editorial Board consisting of J. Dankmeijer, K. Fleischhauer, H. Frick, B. Kummer, M. Okamoto, S.L. Palary, K. Theiler and F. Walberg. In 1974, a subtitle Journal of Anatomy and Embryology was introduced but used for two volumes only. From volume 146 the primary title became Anatomy and Embryology. In 1974 G. Raisman replaced J. Dankmeijer on the Editorial Board. In 1978, with volume 155, K. Fleischhauer and S.L. Palary became the Managing Editors and the Editorial Board consisted in addition of R. Bellairs, G. Burnstock, N. Le Douarin, H.-R. Duncker, W.-G. Forssmann, M.D. Gershon, K. Hama, W. Kriz, R. Nieuwenhuys, K. Theiler and F. Walberg. Beginning with volume 171, 1985 the Managing Editors were: R. Bellairs, K. Fleischhauer, W.-G. Forssmann, W. Kriz, S.L. Palary, F. Walberg. Editors: G. Burnstock, B. Christ, N. Le Douarin, H.-R. Duncker, G. Gabella, M.D. Gershon, K. Hama, E. Mugnaini, R. Nieuwenhuys, and K. Zilles.

#### Copyright

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Special regulations for photocopies in the USA: Photocopies may be made for personal or in-house use beyond the limitations stipulated under Section 107 or 108 of U.S. Copyright Law, provided a fee is paid. This fee is US\$0.20 per page, or a minimum of US\$1.00 if an article contains fewer than five pages. All fees should be paid to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA, stating the ISSN 0340-2061, the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

Printers: Universitätsdruckerei H. Stürtz AG, Würzburg

© by Springer-Verlag Berlin Heidelberg 1987 Springer-Verlag GmbH & Co KG, D-1000 Berlin 33 Printed in Germany

# **Contents**

No. 1 pp. 1–134 issued in April 1987		Flamme, I.: Prolonged and simplified in vitro culture	45-52
No. 2 pp. 135–266 issued in June 1987		of explanted chick embryos	165–174
No. 3 pp. 267–400 issued in July 1987		Turber, S.L., S. Okado, III, ot all	393–399
No. 4 pp. 401–530 issued in September 1987		Gallall, 1., 5. Hulle, 5.141.	79–85
••		García-Martínez, V., s. Navascués, J., et al.	463-475
		Gaspar, 1., s. verney, c., et al.	145–154
Abrahamsohn, P.A., s. Katz, S.		Giletti, B., S. Illariiou, E.C., et al.	87-97
Alvarez, C., s. Verney, C., et al	463–475	Gossrau, R., s. Merker, HJ., et al.	35-40
Alvarez, I.S., s. Navascués, J., et al.	79–85	Greve, T., s. Hyttel, P., et al.	33-40
Alvarez, M., s. Strauss, M., et al.		Groen, G.J., Baljet, B., Boekelaar, A.B., Drukker, J.:	
Amselgruber, W., s. Spanel-Borowski, K., et al	387–391	Branches of the thoracic sympathetic trunk in the	401-411
Anderson, S., Ede, D.A.: Eye development in the nor-		human fetus	401 111
mal and <i>Pupoid foetus</i> ( <i>pf/pf</i> ) mutant mouse Anselmi, G., s. Strauss, M., et al		W.H., Jong, F. de, Los, J.A., Moorman, A.F.M.:	
Antonopoulos, J., s. Dinopoulos, A., et al.	231–237	Isomyosin expression in developing chicken atria: a	
Aoki, A., s. Orgnero de Gaisán, E	65–70 525–530	marker for the development of conductive tissue?	515-523
Arguello, C., s. Strauss, M., et al.	231–237	Gulamhusein, N., s. Tarara, R., et al.	267-275
Arrechedera, H., s. Strauss, M., et al.	231–237	Haddad, A., Pelletier, G.: Radioautographic study of	
Arsenault, P., s. Ménard, D.	441–448	glycoprotein synthesis and fate in the hypothalamo-	
Ayesta, C., s. Strauss, M., et al.	231–237	neurohypophyseal system of vasopressin-deficient	
Baljet, B., s. Groen, G.J., et al.	401–411	Brattleboro rats	501-514
Barrach, HJ., s. Merker, HJ., et al.	87–97	Halata, Z., s. Strasmann, T., et al.	1-12
Beattie, M.S., s. Campbell, H.L., et al		Hara, K., s. Wiertz-Hoessels, E.L.M.J., et al.	337-343
Berciano, M.T., Lafarga, M.: Cajal-Smirnow ansiform	100	Hazlett, J.C., s. King, J.S., et al.	191-202
fibers in the molecular layer of the rat cerebellar cor-		Hearn, J.P., s. Tarara, R., et al.	267-275
tex	367-372	Hekking, J.W.M., s. Wiertz-Hoessels, E.L.M.J., et al.	337-343
Berger, B., s. Verney, C., et al.	463-475	Hendrickx, A.G., s. Tarara, R., et al	267–275
Bishop, G.A., s. King, J.S., et al.	191-202	Hodges, J.K., s. Tarara, R., et al.	267–275
Boekelaar, A.B., s. Groen, G.J., et al	401-411	Homma, S., s. Okado, N., et al	175–182
Bravo, H., Inzunza, O.: Motor innervation of the bursa-		Hurle, J.M., Gañan, Y.: Formation of extra-digits indu-	
lis muscle (nictitating membrane) in the lizard Callo-		ced by surgical removal of the apical ectodermal	
pistes maculatus	277-280	ridge of the chick embryo leg bud in the stages pre-	1000
Bremer, D., s. Merker, HJ., et al	87–97	vious to the onset of interdigital cell death	393–399
Bresnahan, J.C., s. Campbell, H.L., et al	155–163	Hyttel, P.: Bovine cumulus-oocyte disconnection in vitro	41–44
Brière, N.: Human foetal kidney explants in serum-free		Hyttel, P., Xu, K.P., Smith, S., Callesen, H., Greve, T.:	
organ culture	105–114	Ultrastructure of the final nuclear maturation of bo-	25 40
Buse, E.: Ventricular cells from the mouse neural plate,		vine oocytes in vitro	35-40
stage Theiler 12, transform into different neuronal		Inzunza, O., s. Bravo, H	277–280
cell classes in vitro	295–302	Irby, D.C., s. Kerr, J.B., et al.	213-224
Callesen, H., s. Hyttel, P., et al.	35-40	Ito, K., s. Komiyama, M., et al	183–189
Campbell, H.L., Beattie, M.S., Bresnahan, J.C.: Cir-		Ito, R., s. Okado, N., et al	175–182 515–523
cumferential cells of the developing Rana catesbeiana lumbar spinal cord	155 162	Jong, F. de, s. Groot, I.J.M. de, et al.	65–70
Carpenter, S.J.: Developmental analysis of cephalic	155–163	Karamanlidis, A.N., s. Dinopoulos, A., et al Katz, S., Abrahamsohn, P.A.: Involution of the antime-	03-70
axial dysraphic disorders in arsenic-treated hamster		sometrial decidua in the mouse. An ultrastructural	
embryos	345-365		251-258
Codesal, J., s. Paniagua, R., et al.	225–230	study	231-236
Dinopoulos, A., Karamanlidis, A.N., Michaloudi, H.,	223-230	possible function of giant crystalloids in the Sertoli	
Antonopoulos, J., Papadopoulos, G.: Retinal projec-		cell of the juvenile and adult koala ( <i>Phascolarctos</i>	
tions in the hedgehog (Erinaceus europaeus). An au-		cinereus)	213-224
toradiographic and horseradish peroxidase study	65-70	Kin Loo, S., s. Strasmann, T., et al.	1-12
Dohr, G., Tarmann, T., Schiechl, H.: Different antigen		King, J.S., Morgan, J.K., Bishop, G.A., Hazlett, J.C.,	
expression on Wolffian and Müllerian cells in rat		Martin, G.F.: Development of the basilar pons in	
embryos as detected by monoclonal antibodies	239-242	the North American oppossum: dendrogenesis and	
Donkelaar, H.J. ten, s. Linden, J.A.M. van der	431-439	maturation of afferent and efferent connections	191-202
Drukker, J., s. Groen, G.J., et al	401-411	Kitamura, H., s. Tsuzuki, H.	303-311
Drukker, J., s. Wiertz-Hoessels, E.L.M.J., et al	337-343	Knell, C.M., s. Kerr, J.B., et al.	213-224
Dubbeldam, J.A., s. Smits-van Prooije, et al	71-77	Koebke, J., s. Werner, J.A.	127-131
Ede, D.A., s. Anderson, S	243-249	Komiyama, M., Ito, K., Shimada, Y.: Origin and deve-	
Eglmeier, W.: The development of the Merkel cells in		lopment of the epicardium in the mouse embryo	183-189
the tentacles of Xenopus laevis larvae	493-500	Kriz, W., s. Sakai, T.	373-386
Eley, R.B., s. Tarara, R., et al.	267-275	Kucera, J., Walro, J.M.: Postnatal maturation of spind-	
Else, J.G., s. Tarara, R., et al.	267–275	les in deafferented rat soleus muscles	449-461
Enders, A.C., s. Tarara, R., et al.	267–275	Kuhn, HJ., Liebherr, G.: The early development of	
Endo, A., Sakai, N.: The incidence of tail flexion to		the heart of Tupaia belangeri, with reference to other	
the left side in mouse embryos	133–134	mammals	53-63
Flamme, I.: Edge cell migration in the extraembryonic		Lafarga, M., s. Berciano, M.T.	367-372
mesoderm of the chick embryo. An experimental and	455 101	Lamers, W.H., Spliet, W.G.M., Langemeyer, R.A.T.M.:	
morphological study	477–491	The lining of the gut in the developing rat embryo.	

Its relation to the hypoblast (primary endoderm) and		the rat	115–126
the notochord	259-265	Puelles, L., Martinez-de-la-Torre, M.: Autoradiographic	
Lamers, W.H., s. Groot, I.J.M. de, et al	515-523	and Golgi study on the early development of n.	
Langemeyer, R.A.T.M., s. Lamers, W.H., et al.	259-265	isthmi principalis and adjacent grisea in the chick	10.24
Leeuwen, J.L. van, s. Poelmann, R.E., et al	99–103	embryo: a tridimensional viewpoint	19-34
Liebherr, G., s. Kuhn, HJ.	53-63	Rodríguez, M.C., s. Paniagua, R., et al.	225–230 79–85
Linden, J.A.M. van der, Donkelaar, H.J. ten: Observa-		Rodríguez-Gallardo, L., s. Navascués, J., et al.	133–134
tions on the development of cerebellar afferents in		Sakai, N., s. Endo, A.	133-134
Xenopus laevis	431–439	Sakai, T., Kriz, W.: The structural relationship between	
Los, J.A., s. Groot, I.J.M. de, et al.	515-523	mesangial cells and basement membrane of the renal	272 206
Low, W.C., s. Triarhou, L.C., et al.	145–154	glomerulus	373-386
Maler, L., s. Mugnaini, E.	313–336	Sanders, E., s. Groot, I.J.M. de, et al.	515-523
Martin, G.F., s. King, J.S., et al.	191–202	Sano, Y., s. Mori, S., et al.	13–18 225–230
Martinez-de-la-Torre, M., s. Puelles, L	19–34	Santamaría, L., s. Paniagua, R., et al.	239-242
Martín-Partido, G., s. Navascués, J., et al.	79–85	Schiechl, H., s. Dohr, G., et al.	239-242
Matsuura, T., s. Mori, S., et al.	13–18	Schmolke, C.: Morphological organization of the neuro-	203-212
Ménard, D., Arsenault, P.: Human fetal colon in organ	4.44 4.40	pil in laminae II–V of rabbit visual cortex	183–189
culture	441–448	Shimada, Y., s. Komiyama, M., et al.	387–391
Mentink, M.M.T., s. Poelmann, R.E., et al.	99–103	Sinowatz, F., s. Spanel-Borowski, K., et al	35-40
Mentink, M.M.T., s. Smits-van Prooije, et al	71–77	Smith, S., s. Hyttel, P., et al.	33-40
Merker, HJ., Bremer, D., Barrach, HJ., Gossrau, R.:		Smits-van Prooije, A.E., Vermeij-Keers, Chr., Dubbel-	
The basement membrane of the persisting maternal	97.07	dam, J.A., Mentink, M.M.T., Poelmann, R.E.: The formation of mesoderm and mesectoderm in preso-	
blood vessels in the placenta of Callithrix jacchus	87–97 65–70	mite rat embryos cultured in vitro, using WGA-Au	
Michaloudi, H., s. Dinopoulos, A., et al	515-523	as a marker	71-77
Morgan, J.K., s. King, J.S., et al.	191–202	Spanel-Borowski, K., Amselgruber, W., Sinowatz, F.:	11 11
Mori, S., Matsuura, T., Takino, T., Sano, Y.: Light	191-202	Capillary sprouts in ovaries of immature superstimu-	
and electron microscopic immunohistochemical stu-		lated golden hamsters: a SEM study of microcorro-	
dies of serotonin nerve fibers in the substantia nigra		sion casts	387-391
of the rat, cat and monkey	13–18	Spliet, W.G.M., s. Lamers, W.H., et al.	259-265
Mugnaini, E., Maler, L.: Cytology and immunocytoche-	15 10	Straaten, H.W.M. van, s. Wiertz-Hoessels, E.L.M.J.,	207 200
mistry of the nucleus extrolateralis anterior of the		et al	337-343
mormyrid brain: possible role of GABAergic synap-		Strasmann, T., Halata, Z., Kin Loo, S.: Topography	
ses in temporal analysis	313-336	and ultrastructure of sensory nerve endings in the	
Müller, F., O'Rahilly, R.: The development of the hu-		joint capsules of the Kowari (Dasyuroides byrnei),	
man brain, the closure of the caudal neuropore, and		an Australian marsupial	1-12
the beginning of secondary neurulation at stage 12	413-430	Strauss, M., Arrechedera, H., Arguello, C., Ayesta, C.,	
Navascués, J., Martín-Partido, G., Alvarez, I.S., Rodrí-		Alvarez, M., Anselmi, G.: Mesenchymal tissue of	
guez-Gallardo, L., García-Martínez, V.: Glioblast		the interventricular septum. Structural and ultra-	
migration in the optic stalk of the chick embryo	79-85	structural study	231-237
Nistal, M., s. Paniagua, R., et al.	225-230	Takino, T., s. Mori, S., et al.	13-18
Okado, N., Ito, R., Homma, S.: The terminal distribu-		Tarara, R., Enders, A.C., Hendrickx, A.G., Gulamhu-	
tion pattern of spinocerebellar fibers. An antero-		sein, N., Hodges, J.K., Hearn, J.P., Eley, R.B., Else,	
grade labelling study in the posthatching chick	175–182	J.G.: Early implantation and embryonic develop-	
Okado, N., Yoshimoto, M., Furber, S.E.: Pathway for-		ment of the baboon: stages 5, 6 and 7	267-275
mation and the terminal distribution pattern of the		Tarmann, T., s. Dohr, G., et al.	239-242
spinocerebellar projection in the chick embryo		Thors, F., s. Wiertz-Hoessels, E.L.M.J., et al.	337–343
O'Rahilly, R., s. Müller, F	413–430	Triarhou, L.C., Low, W.C., Ghetti, B.: Transplantation	
Orgnero de Gaisán, E., Aoki, A.: Permeability studies		of cerebellar anlagen to hosts with genetic cerebello-	
of the guinea pig placental labyrinth. III. Tracer studies of the materno-fetal barrier	525 520	cortical atrophy	145–154
Ovalle, W.K.: The human muscle-tendon junction. A	525–530	Tsuzuki, H., Kitamura, H.: Cholinergic traits in rat	
morphological study during normal growth and at		mandibular processes observed by electron micros-	202 211
maturity	281-294	copy	303–311
Pabst, R.: The anatomical basis for the immune function	201-294	Verney, C., Gaspar, P., Alvarez, C., Berger, B.: Postna-	71–77
of the gut	135–144	tal sequential development of dopaminergic and en-	
Paniagua, R., Codesal, J., Nistal, M., Rodríguez, M.C.,	133 144	kephalinergic perineuronal formations in the lateral	
Santamaría, L.: Quantification of cell types through-		septal nucleus of the rat correlated with local neuro-	
out the cycle of the human seminiferous epithelium		nal maturation	463-475
and their DNA content. A new approach to the sper-		Visser, S.D., s. Groot, I.J.M. de, et al.	515-523
matogonial stem cell in man	225-230	Walro, J.M., s. Kucera, J.	449-461
Papadopoulos, G., s. Dinopoulos, A., et al	65-70	Werner, J.A., Koebke, J.: The function of the antebran-	
Pelletier, G., s. Haddad, A	501-514	chial interosseous membrane	127-131
Poelmann, R.E., Mentink, M.M.T., Leeuwen, J.L. van:		Wiertz-Hoessels, E.L.M.J., Hara, K., Hekking, J.W.M.,	, 151
Axial rotation of murine embryos, a study of asym-		Straaten, H.W.M. van, Thors, F., Drukker, J.: Diffe-	
metric mitotic activity in the neural tube of somite		rentiation of gut endoderm in dependence of the no-	
stages	99-103	tochord	337-343
Poelmann, R.E., s. Smits-van Prooije, et al	71-77	Xu, K.P., s. Hyttel, P., et al.	35-40
Powley, T.L., s. Prechtl, J.C.	115–126	Yoshimoto, M., s. Okado, N., et al	165-174
Prechtl, J.C., Powley, T.L.: A light and electron micros-			
copic examination of the vagal hepatic branch of		Indexed in Current Contents	